

Cooperative Appraisals for Capability and Risk Evaluation

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The U.S. Army Communications-Electronics Life Cycle Management Command Software Engineering Center is working with the Software Engineering Institute in creating a framework for cooperative government/industry appraisals for process improvement and risk evaluation. Traditionally, solicitations for Department of Defense projects have included some sort of risk evaluation. Though risk evaluations are only one component of a source selection, all bidders underwent the risk evaluation site visit, costing the government significant time and effort in evaluating potentially several organizations that would not perform the work solicited. The concept developed is to partially base an award on the merits of a process proposal with the understanding that an on-site evaluation would follow after contract award. Another aspect of these appraisals is that representatives from the government and the organization being appraised work together on the appraisal team to jointly evaluate the organization. This article describes the efforts of the authors in performing post-award cooperative appraisals, the lessons learned, and the benefits to both the government and the appraised organization.

Traditionally, solicitations for Department of Defense (DoD) projects have included some method of risk evaluation to determine the level of risk that the project manager (PM) will face in selecting a bidder to provide the products/services for his or her program. This risk evaluation could take the form of a Software Capability Evaluation (SCESM), a methodology developed by the Software Engineering Institute (SEISM) at Carnegie Mellon University, or other methods.

The Communications-Electronics Life Cycle Management Command (C-E LCMC) Software Engineering Center (SEC) developed a streamlined form of the evaluation called the Software Process Risk Evaluation (SPRE) that has been mandated for all major C-E LCMC acquisitions. This method, like the SCE, has been used during the solicitation process to evaluate all potential vendors and provide input to the evaluation factors for the solicitation.

There were several problems with the SCE and SPRE methods. There often was not enough time to prepare for the evaluation. A lack of historical information about the bidders' processes made the evaluations more critical while decreasing the effectiveness of a short, intense on-site visit. The cost of the evaluations were high for both the government, who has to visit all of the bidders during the proposal evaluation period, and the contractor, who has to apply significant resources to prepare data and provide people to be interviewed during the on-site visit. Both parties potentially spend money to support multiple source selection evaluations. The government expends resources to

evaluate the losing contractors, and the contractor could possibly have to support multiple evaluations in a given timeframe.

Acquisition Reform

Industry has matured over the years. The SEI issued the Capability Maturity Model[®] for Software (SW-CMM[®]) in 1993. Since that time, many of the organizations that bid on acquisition solicitations have undergone process improvement initiatives using SW-CMM or its successors, including the CMM IntegrationSM (CMMI[®]). With the advent of the CMMI, a new appraisal method – the Standard CMMI Appraisal Method for Process Improvement (SCAMPISM) [1] – has been developed and is quickly becoming the appraisal method of choice, regardless of which CMM is being used as the model for process improvement. SCAMPI can be used in lieu of the SCE/SPRE for evaluating bidders during a source selection.

Government acquisition reform has evolved as well. The Interim Defense Acquisition Guidebook, paragraph C5.2.3.5.6.1.5, states the following:

Select contractors with domain experience in developing comparable software systems; with successful past performance; and with a mature software development capability and process. Contractors performing software development or upgrade(s) for use in an [Acquisition Category] ACAT I or ACAT IA program shall undergo an evaluation, using either the tools developed by the [SEI] or those approved by both the DoD Components and the Deputy Director, Software Intensive Sys-

tems. At a minimum, full compliance with SEI Capability Maturity Model Level 3, or its equivalent in an approved evaluation tool, is the department's goal. However, if the prospective contractor does not meet full compliance, risk mitigation planning shall describe, in detail, the schedule and actions that will be taken to remove deficiencies uncovered in the evaluation process. Risk mitigation planning shall require Product Manager approval. The Deputy Director, Software Intensive Systems shall define Level 3 equivalence for approved evaluation tools. The evaluation shall examine the business unit proposed to perform the work. The reuse of existing evaluation results performed within a 2-year period prior to the date of the government solicitation is encouraged. [2]

Later guidance clarified Level 3 equivalence. The Software Development Capability Evaluation [3], developed by the U.S. Air Force with approved core set revisions, was determined to be an acceptable alternative set of criteria to the SW-CMM. The use of CMMI Systems Engineering and Software Engineering Vers. 1.1 Level 3 criteria is another acceptable alternative to the use of SW-CMM Level 3 criteria.

Newer guidance from the Office of the Secretary of Defense/Acquisition, Technology, and Logistics no longer requires Level 3 equivalent ratings. Process improvement is encouraged, but maturity levels are no longer stated in the guidance. The rationale is that many organizations have reached maturity Level 3 or better, and that the original

SM CMM Integration, SCE, SCAMPI, and SEI are service marks of Carnegie Mellon University.

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direction was not to have organizations go for the rating, but to initiate organizational process improvement.

The CMMI, in its continuous representation, allows an organization to be appraised to determine a process capability profile; the organization can look at Process Areas (PAs) of interest based on organizational goals and see how well they have implemented them. This can also allow a PM to focus on areas that are of high risk for a particular acquisition, rather than look at overall maturity across all PAs.

Appraisal Reuse

To reduce costs and resources associated with evaluating development capabilities, the DoD is working with industry to provide implementing mechanisms that better support the reuse of appraisals. Results of previous appraisals conducted on the organizational unit proposing to do the work may be an acceptable alternative to the government performing a new appraisal. The reused appraisals must be shown to be independent, i.e., at a minimum, the lead appraiser should not be from within the organization being appraised.

C-E LCMC Acquisition Strategy

The SEC has been involved in the examination of cooperative government/industry appraisals as an alternative to the conventional acquisition strategy for several years [4]. The SEC took the initiative in working with the acquisition center at Fort Monmouth to identify software-intensive acquisitions occurring there. The interim project office was contacted and cost-effective strategies developed to address the acquisition agent's need to reduce risk. One of these strategies was to wait until after contract award and perform a post-award appraisal of the successful bidder.

To make the post-award appraisal viable, the solicitation package must have the appropriate language. The contract should require that the product be developed using CMM/CMMI Level 3 processes. Proof is to be submitted, demonstrating that the contractor is rated as a Level 3 organization (e.g., copies of CMM/CMMI appraisals and process improvement track record). If the organization cannot verify Level 3, a detailed process improvement plan, including a schedule that leads to a Level 3 appraisal is submitted. This provides the acquisition agent with material in which to evaluate the bidders' process maturity during the source selection without the effort required for on-site visits.

The post-award appraisal must also be

contained in the contract. Typically, C-E LCMC requires that the contractor is responsible for leading and conducting an appraisal with government participation on the appraisal team. This is appropriate as it is the contractor's plant and processes. The contractor is required to submit an appraisal plan or process proposal as a formal deliverable after the contract is awarded.

If a CMMI SCAMPI appraisal is selected or required, additional options present themselves. The SCAMPI framework defines three classes of appraisal. A Class C appraisal is a very cursory look at the processes of the organization. It can often be nothing more than a review of process documentation and its application to the project. A Class B appraisal is more

Office of the Secretary of Defense. This approach, reported by Mike Phillips in "CMMI: A Progress Report" [5], would have acquirers look for strengths or weaknesses in the development processes that constitute risks to the proposed development effort. Satisfying CMMI goals, process areas, or maturity or capability levels would not be the point; it is primarily a risk identification and mitigation approach.

Schaeffer suggests a three-phased approach. In phase 1, bidders would be appraised for PAs that the Government Program Office considers highest risk. After contract award, in phase 2, the winning team undergoes a baseline appraisal, using a risk-based analysis of the process strengths and weaknesses, thereby establishing action plans for future checks. In a risk-based appraisal framework, the CMMI is used to identify and group weaknesses to address systemic problems. The CMMI's process categories – Project Management, Engineering, Support, and Process Management – may be used to define areas that the PM believes most affects the developer team's contract performance. Using these categories effectively covers both product and process risk. In phase 3, the risks are monitored to closure.

Tying CMMI/risk mitigation to an award fee on a contract vehicle can be a good incentive for the contractor. A program office should consider wording the contract to have a continuous process monitoring function. For example, a PM could elect to utilize the Defense Contract Management Agency (DCMA) or some other matrix organization to perform process monitoring. This is also a recommendation made in the Workshop on CMMI Use in Acquisition [6].

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robust, but does not emphasize the depth of coverage and rigor that result in a maturity level rating for the organization. Class A appraisals are performed by SEI-authorized SCAMPI lead appraisers. They can lead to a formal maturity rating or capability profile that is submitted to the SEI. The government determines which class SCAMPI appraisal is appropriate for the acquisition.

With the SEI developing formal mechanisms for SCAMPI B and C appraisals, this methodology is fitting into a DoD approach suggested by Mark Schaeffer, the DoD sponsor for CMMI, and Director, Systems Engineering for the

Benefits of Post-Award Appraisals

The PM saves resources by limiting the number of appraisals required for a solicitation. Maturity risk is only one of many evaluation factors for an acquisition source selection evaluation. The increased risk of not performing an on-site evaluation for each bid is mitigated by the cost and time savings. Many organizations have been performing process improvement initiatives for more than 10 years. This legacy of process improvement tends to ensure that processes are defined, which is the focus of maturity Level 3 in the CMM/CMMI.

The bidders benefit in this approach as well. Organizations can reuse their

Attribute	SCE/SPRE/SCAMPI	Cooperative Appraisal
Timeframe	<ul style="list-style-type: none"> Pre-award. May be used post-award for contract monitoring. 	<ul style="list-style-type: none"> Pre-award or post-award. Recommend post-award baseline and follow-on for contract monitoring. Can be linked to supplier's process improvement appraisal schedule.
Cost	<ul style="list-style-type: none"> High (both supplier and acquirer). 	<ul style="list-style-type: none"> Lower (cost sharing).
Cost Effectiveness	<ul style="list-style-type: none"> Low, especially if supplier must support evaluations for losing solicitation. 	<ul style="list-style-type: none"> High. Eliminates cost of evaluating losing bidders.
Resources Needed	<ul style="list-style-type: none"> Resource-intensive. 	<ul style="list-style-type: none"> Resource sharing for staffing appraisals. Supplier can reuse process data.
Incentive for Process Improvement	<ul style="list-style-type: none"> Little if no contractual language for process improvement. 	<ul style="list-style-type: none"> Supplier can reuse process assets developed for process improvement. Potential for appraisal reuse on subsequent solicitations.
Integrated Product Development	<ul style="list-style-type: none"> Government-only team does not form integrated teams with supplier. 	<ul style="list-style-type: none"> Fosters early development of integrated teams. Facilitates government/supplier communication.
Risk	<ul style="list-style-type: none"> Mitigates selection of high-risk bidders. Does not allow for an in depth risk evaluation of the supplier unless applied post-award. 	<ul style="list-style-type: none"> Early risk mitigation if performed early in contract execution. Continuous risk monitoring and control if used for contract monitoring.

Table 1: *Evaluation and Cooperative Appraisal Attributes*

process data for multiple solicitations. They do not have the expense of preparing for an on-site visit for a solicitation that they are not guaranteed to win. Cooperative appraisals reward the organization for its process improvement efforts, thereby encouraging internal process improvement activities. Table 1 summarizes the attributes and how conventional evaluations compare/contrast to the cooperative appraisal methodology.

Pilot Effort for Cooperative Appraisals

The SEC was able to participate in an ACAT I acquisition where the PM was consulted before the release of the Statement of Work (SOW). After being briefed on the benefits of performing a post-award appraisal, the PM agreed to have language added to the SOW for a CMMI self-assessment of all major contributors to the product development effort using the SCAMPI method with up to four government participants.

The winning contractor team submitted an assessment plan to have four teammates undergo a self-assessment. The original plan called out in the SOW was to submit the plan within 60 days after contract award and perform the self-assessments within 120 days after contract award. The assessment would establish a process capability baseline on the organizational unit doing the work on the program as well as determine risk areas to be

monitored over the acquisition life cycle. Since the contract was awarded to a team of contractors, consideration was given to the timing requirements for both the plan and the conduct of the self-assessments. The SOW provided a list of CMMI PAs of interest. These were the minimum set of processes that were to be assessed, which tied into the program office's key performance parameters, goals, and objectives for the program.

Using multi-organizational teams brings a new risk to the conventional acquisition evaluation methodology. The contracting team may have individually performed process improvement efforts, but the team does not necessarily share institutionalized processes. Former assessments are not directly applicable to the newly formed team and are less predictive of the maturity or capability of the team doing the work.

In this pilot, the prime contractor worked to develop capstone processes that all teammates would follow, but additionally allowed for the individual organization's processes to be used. For example, a project Software Development Plan (SDP) was written by the prime, which called out use of the other organizations' SDPs for their software contributions to the project.

The contractor's self-assessment plan called for self-assessments to be held at multiple organizations. Each self-assessment covered all maturity Level 2 and 3

PAs. Some sites added higher maturity PAs. The government worked with the contractor team to try to leverage each organization's internal process improvement activities. All of the contractors were transitioning from SW-CMM to CMMI; they were already implementing organizational process improvement plans.

Where feasible, the government allowed the organization to add the acquisition project to the list of internal projects being appraised to avoid unnecessary effort of preparing for an independent assessment of one program. For at least one organization, this meant scheduling the appraisal as part of their externally led SCAMPI. This benefited the government as well, since the project was not yet fully under way and, therefore, many PAs (e.g., technical solution, verification, and validation) could not be rigorously assessed – the project simply was not to that point in its life cycle. The addition of projects in different stages of maturity provided a more rounded picture of the organization and how its institutionalized processes would be applied to a future project.

The SEC provided the two authors as the core team that participated on the self-assessments. Using available local DCMA representatives augmented government participation. The PM had contracted with DCMA to perform process monitoring over the course of the development effort, so their participation in the self-assessments acted as a kick-start in understanding the details of the project's processes.

Cooperative Appraisals and the CMMI

The way that acquisition reform is evolving is similar to that of the evolution from SW-CMM to CMMI. CMMI provides integration of software with other disciplines, i.e., systems engineering and integrated product and process development (IPPD), manifested in integrated product teams (IPTs).

There is an analogous evolution in acquisition – a paradigm shift from the traditional buyer-seller relationship to that of an IPT where both the government and contractor share responsibility for the end product. This integrated team concept necessitates a team approach to assessment as well. In a cooperative appraisal, the government participants add objectivity and diverse experience. The team that is formed during cooperative appraisals can be extended to established IPTs for the acquisition life cycle, where

government participants in the assessment can also be members of the government's project management team.

Anyone who has participated in an SEI appraisal can attest to the fact that the intensity of the shared experience does much to foster team building. A foundation of mutual respect, equality, and cooperation is established throughout an appraisal. These sentiments can be brought back to the project management office and used to continuously facilitate communication between the government and contractor. The cooperative appraisal process allows both parties to utilize and benefit from the appraisal data; there is open process communication between the government and their contractor. This gives the government an understanding of the way the contractor does business.

The government gets to meet the key players, from the president of the corporation to the practitioners at the developer's site, and may additionally see the facilities and operations for the project. This interaction establishes positive working relationships and provides a greater understanding of what the government/contractor IPT brings to the program.

In a cooperative appraisal, the government leverages the project and process expertise brought by the contractor, thus facilitating the government's assessment efforts. Usually there are appraisal team members that are part of the contractor's process improvement group or belong to the team working on one of the projects being appraised. These people can quickly guide the government appraisal team member to the appropriate process artifacts or answer appraisal-focused questions.

Lessons Learned

There was some trepidation on the part of the contractors in performing the cooperative appraisal. It was initially perceived that the government representatives were coming in to perform an audit or evaluation, not to participate in an internal process appraisal. Discussions with the site coordinator and contractor management before the appraisal helped overcome these perceptions.

The government representatives explained that the cooperative appraisals were one more manifestation of the IPT method of running a program where the government and the contractor share responsibility for the program's success. The contractors were reminded that their organization's formal appraisal teams are often composed of personnel external to the organization, and that the government

representatives' goal was to be integral members of the team. The measure of success would be how forthcoming those interviewed were during the self-assessment. Since many of the people interviewed had experience with internal appraisals, where they may speak with people outside of their business unit or external people, the cooperative appraisal team did not experience any difficulties in this area.

Internal process improvement requires senior management commitment. The cooperative appraisal teams usually are comprised of several process group members. These process group personnel are responsible for recommending the future direction of process improvement efforts in the organization. The organizations being appraised were transitioning from CMM to CMMI; some had never piloted a CMMI appraisal. This provided an opportunity for the process group to

avoids misinterpretations.

Having a core team of government participants on all of the appraisals provided continuity. The same personnel can compare and contrast how the different organizations are performing process improvement and satisfying the practices of the CMMI. Common areas of weakness and interpretation issues can be raised and addressed to better support the program.

If the government provides several people for a cooperative appraisal, they should represent the major disciplines (e.g., program management, systems engineering, software engineering, and logistics) that are involved in the acquisition. A multi-disciplinary team can cover a broader range of PAs, while a given government team member can specialize in his or her area of expertise. Involving multiple disciplines allows the government to examine the developers' processes, taking into consideration the entire program life cycle. This enables downstream risks to be identified early in the acquisition. These risks can be mitigated with less effort as a result of the early collaboration and expertise among the government appraisal team and the developers' project teams.

PMs considering using cooperative appraisals should enlist direct or matrix support from the PM office for participation on the appraisal team. The detailed view of the organization is extremely valuable to a person who is supporting the PM in managing the acquisition. The appraisal team member gets to meet and speak with many of the people performing the project work, interview senior management, and understand their commitment to the project.

As participants of several appraisals, the authors can state that an extremely beneficial byproduct of being on an appraisal team is that you can learn of many practices that can be adapted for use in your organization. No organization has a monopoly on best practices. The more exposure that you have to the industry, the more you can recognize there are superior ways of doing things.

Aftermath

The joint appraisals were considered to be a success by both the government and industry. Two of the teammates who had been appraised invited the government representatives back for a follow-on appraisal where the company was trying to achieve a higher maturity level. These organizations valued the government's contributions to the appraisal effort, and wished to maintain the same experienced

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gather valuable information on the state of the organization and how successfully the transition efforts were proceeding. The external inputs from the government can assist the process group by providing an unbiased view of the organization, and help influence senior management in determining what areas the organization should be concentrating on in their future process improvement initiatives.

The government gained insight into the different cultures of the organizations comprising the contractor team. They had different ways of doing business, different vocabularies, and different ways of working with the prime contractor and the government. Understanding these differences aids in facilitating communications among the members of the IPTs and



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appraisal team in this follow-on appraisal. The government, in turn, appreciated the opportunity to follow up on re-appraising the organizations. This allowed the government the ability to witness the effect of the process improvements made in the organizations since the self-assessment.♦

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